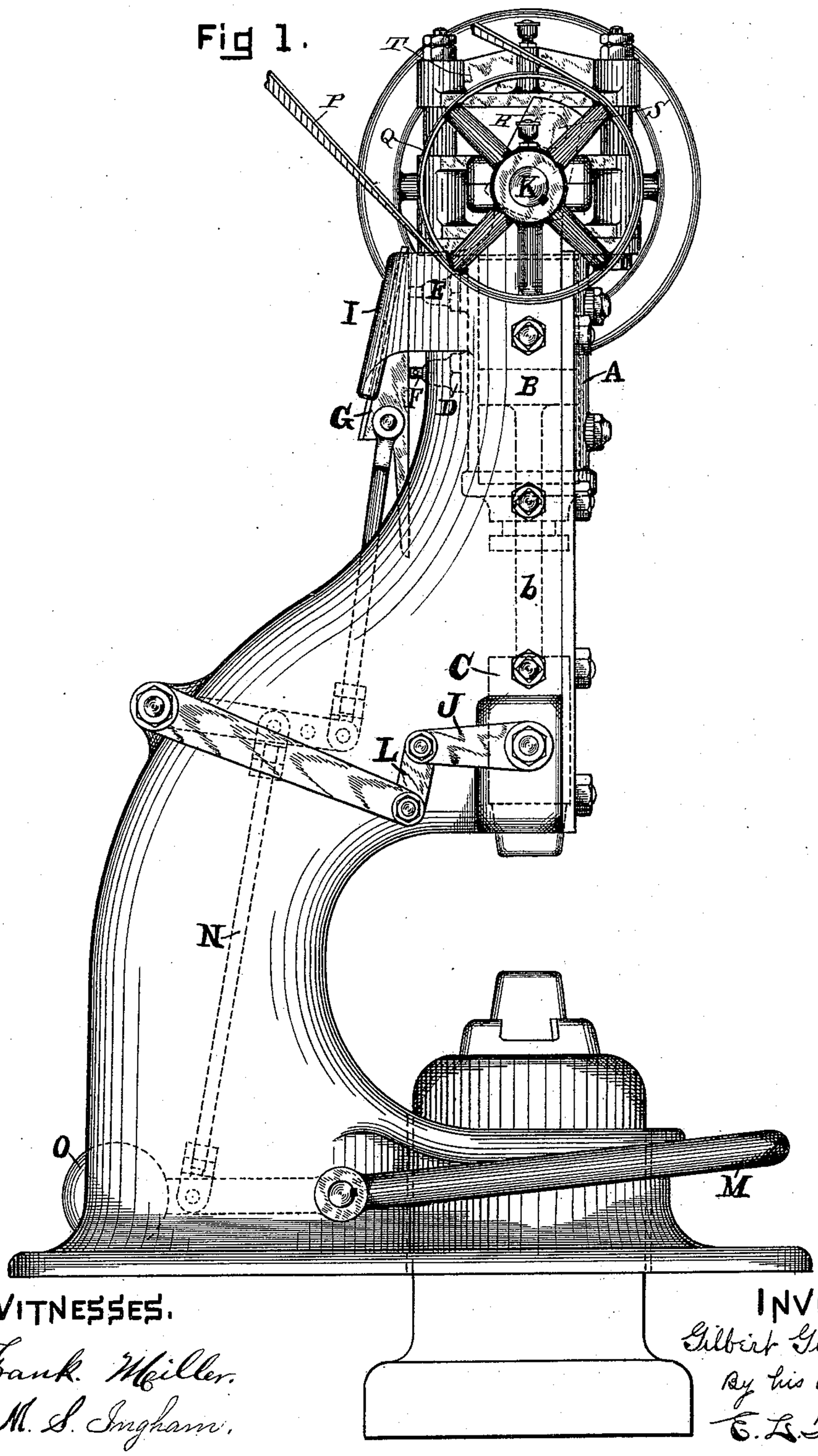
(No Model.) 2 Sheets—Sheet 1.

G. GLOSSOP.

PNEUMATIC HAMMER.

No. 485,498. Patented Nov. 1, 1892.

Fig 1.



WITNESSES.

Frank. Miller.

M. S. Ingham.

INVENTOR.

Gilbert Glossop

By his attorney

E. L. Thurston

(No Model.) 2 Sheets—Sheet 2.

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Fig 2.

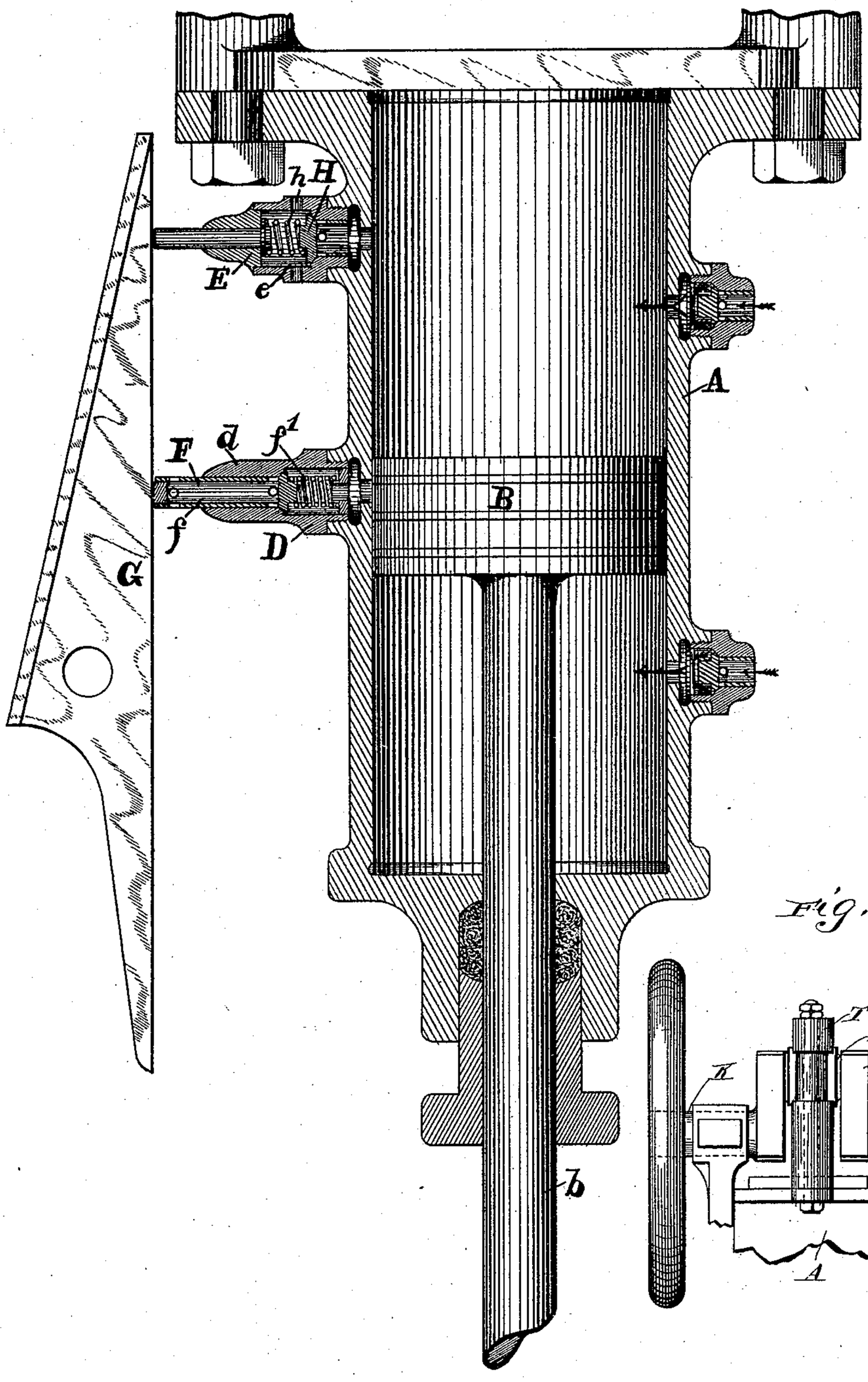

Fig. 3.

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UNITED STATES PATENT OFFICE.

GILBERT GLOSSOP, OF SHEFFIELD, ENGLAND, ASSIGNOR TO FREDERICK CLEMENT BROOKSBANK AND JACOB B. PERKINS, OF CLEVELAND, OHIO.

PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 485,498, dated November 1, 1892.

Application filed August 24, 1891. Serial No. 403,505. (No model.)

To all whom it may concern:

Be it known that I, GILBERT GLOSSOP, a subject of the Queen of Great Britain, residing at Sheffield, in the county of York, England, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is such a clear, full, and exact description as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of pneumatic hammers which are shown and described in Letters Patent Nos. 394,483 and 394,484, granted December 11, 1888, to my assignees, Jacob B. Perkins and Frederick C. Brooksbank.

The object of my invention is to obtain a more perfect control over the movements of the hammer-head, whereby the force of the blow, as well as the point above the block at which the blow is most effectively delivered, may be regulated at will and while the cylinder is in motion.

To this end my invention consists in the construction, combination, and arrangements of parts, as hereinafter described, whereby the amount of air which is compressed relatively above and below the piston may be varied while the cylinder is in motion, all of which will be pointed out definitely in the claims.

The best embodiment of my invention now known to me is illustrated in the drawings, wherein—

Figure 1 is a side elevation of a complete hammer. Fig. 2 is a central vertical section through the cylinder, showing the valves and movable pressure-piece; and Fig. 3 is a detail view of the mechanism for reciprocating the cylinder, taken at right angles to Fig. 1.

I will now proceed to describe in detail the embodiment of my invention which the drawings show, calling attention to the fact that I do not wish to limit my invention to the details shown further than is expressed by the claims.

Power is received from a belt P at the pulley Q and is transmitted by means of a crank-shaft K, crank R, crank-pin S, and Scotch yoke T to a cylinder A, working in suitable guides in the frame of the hammer K, whereby the cylinder is given a vertical reciprocating movement. A piston B within the cylinder is connected by means of the piston-rod *b* (which extends out through the bottom of the cylinder) with the tup or head C, which is also guided by its engagement with the frame. In the front side of the cylinder are two inlet-ports controlled by check-valves, one port being located in the upper and one in the lower part of the cylinder. In the rear side of the cylinder are two outlet-ports D and E, one near the middle thereof and one in the upper part thereof, at a distance from the top equal to about one-fifth of the inside length of said cylinder. It is not pretended that these exact positions are essential to the successful operation of the hammer, but are the positions in which I have secured the most satisfactory results. Over the port D a hollow valve-casing *d* is secured, and the valve F is inclosed in this casing. The valve-stem *f* is tubular and projects outward through the outer end of the casing to a point where it engages with the wedge-shaped pressure-piece G. The valve-chamber in the casing *d* is in communication with the interior of the cylinder at all times; but when the valve F, which moves outward to its seat, is seated the escape of the air outward from said chamber is prevented. A coiled spring *f'* is inclosed in said chamber and thrusts endwise against the valve F, whereby the valve is seated. The pressure outward of the air in the cylinder also tends to seat the valve; but the spring is employed to make the seating movement positive and to hold the valve seated. When the valve is moved from its seat by the pressure of the pressure-piece G against its stem, the air passes from the valve-chamber through the holes into the tubular valve-stem and thence into the atmosphere. The upper outlet-port E is also covered by a valve-casing *e*, and the valve H is inclosed therein. The valve moves inward to seat itself, and when so seated the passage of air from the cylinder to the valve-chamber is prevented. A number of openings are formed through the wall of the valve-casing, through which the air which flows from the cylinder into the valve-chamber

may freely escape. A coiled spring *h*, which is inclosed in the valve-chamber, thrusting endwise against the valve, forces it to its seat. A stem *h'* extends out through the end of the valve-casing. Its outer end is in a position to be engaged by the piece G and its inner end engages with the end of the spring *h*. The valve H is moved from its seat by the pressure of the air from within the cylinder acting against the pressure of the spring *h*. As the stem *h'* is forced in, as hereinafter explained, by the piece G the tension of the spring *h* is increased, whereby a greater air-pressure from within the cylinder is necessary to move the valve away from its seat. The wedge-shaped pressure-piece G presents toward the cylinder a straight side parallel to the line of travel of the cylinder. Its opposite side is beveled and bears against a beveled block I, and it is held in engagement with said block by a tongue-and-groove or other equivalent connection therewith. The lower part of this wedge G is connected with the pivoted lever J by a freely-swinging link L. The lever J is rocked by the movement of the treadle M, with which it is connected by a link N. A weight O on the treadle holds the parts normally in the position shown in Fig. 1. A brake-block at the side of the tup, which is no part of the present invention, but which is fully described in the patents above mentioned, is also operated by the weighted treadle, and when the other parts are in the position shown the tup is held immovable in a raised position by said brake.

The operation of the brake does not in any way change the operation of the new combination of parts herein claimed. It may have some effect in regulating the force of the blow; but this effect is something added to the effect produced by the operation of the valves and does not modify it. The cylinder may be rapidly moving up and down without causing any movement of the hammer-head. When it is desired to start the hammer, the front end of the treadle is pressed down. This movement loosens the brake, whereby the tup is permitted to move, although at first with difficulty, and at the same time substantially begins to move the valve F from its seat and to compress the spring *h*, whereby a greater pressure from within the cylinder is required to move the valve H from its seat. When the treadle is moved down to the limit of its movement, the brake is wholly withdrawn, the valve F is opened wide, and the spring *h* is so compressed that the valve H is held practically closed.

The operation of the device is as follows: When the outlet-valve H is held closed and the outlet-valve F is opened wide, no air can escape from the cylinder except through the middle port. When the upper end of the cylinder and the piston are moving toward each other, all the air between the valve F and the upper end of the cylinder is imprisoned, and when this air is sufficiently compressed the downward movement of the cylinder is transmitted to the piston and it is moved downward; and under this condition of affairs it is moved downward farther and with greater force than when there is a smaller quantity of air imprisoned between the piston and upper end of the cylinder. Another reason exists why the piston moves downward farthest and with greatest force when the valves are in the described condition, viz: Only so much air as is between the valve F and the lower end of the cylinder is imprisoned between said lower end and the piston when the piston passes said valve in its downward movement. Therefore the piston meets with less resistance to its downward movement than it does where there is a greater quantity of air imprisoned in said lower end. When the valve H is permitted to open with greater freedom and the valve F is only partially opened, much of the air in the cylinder escapes through the upper port when the piston is moving upward in the cylinder, and therefore less air is imprisoned in said upper end, and it is not entirely imprisoned until the piston passes above the upper port. For this reason the piston will not be moved down with as much force as under the conditions first explained. At the same time the air cannot escape so freely through the port E, wherefore more air is imprisoned in the lower end of the cylinder, and this offers a greater resistance to said downward movement. In the first case a heavy blow may be delivered by the hammer-head close to the anvil. In the latter case a light blow may be delivered a considerable distance above the anvil. The force of the blow and the point at which it is most effectively delivered may be varied to almost any degree between the two extremes above described by varying the relative openings of the two valves through the movement of the wedge-shaped pressure-block G. In small hammers when a very considerable variation in the force of the blow is not required the upper valve may be omitted altogether, leaving simply an open port, and the variation in the blow would then result wholly from the difference produced by the operation of the middle valve in the air-cushion below the piston, which resists its downward movement.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a pneumatic hammer, in combination, a reciprocating cylinder having a suitable port or ports for admitting air both above and below the piston, means for reciprocating the cylinder, a piston, a piston-rod, a tup, an exhaust-port, a valve for closing said port, arranged to move outward to its seat, and a pressure-piece whereby said valve may be moved inward away from its seat while the cylinder is in motion, substantially as and for the purpose specified.

2. In a pneumatic hammer, the combination of a reciprocating cylinder having suitable air-inlet ports, means for reciprocating the cylinder, a piston, piston-rod, and tup with an air-exhaust port near the upper end of said cylinder, an air-outlet port near the middle of said cylinder, a valve which is normally seated over said last-named port, and mechanism for opening said valve while the cylinder is in motion, for the purpose specified.

3. In a pneumatic hammer, the combination of a reciprocating cylinder having suitable inlet-ports, means for reciprocating the cylinder, a piston, piston-rod, and tup with an exhaust-port near the top of the cylinder, a second exhaust-port near the middle of said cylinder, valves for closing both of said ports, and mechanism for simultaneously opening the lower of said valves and closing the upper while the cylinder is in motion, substantially as and for the purpose specified.

4. In a pneumatic hammer, the combination of a reciprocating cylinder, means for reciprocating the cylinder, a piston, a piston-rod, and tup, said cylinder having suitable inlet-ports, an outlet-port, a valve-chamber secured over said port, a valve contained therein, a spring arranged to force said valve outward to its seat, a valve-stem, and a movable pressure-piece engaging with said stem, whereby said valve may be opened while the cylinder is in motion, for the purpose specified.

5. In a pneumatic hammer, the combination of a reciprocating cylinder having suitable inlet-ports, means for reciprocating the cylinder, a piston, piston-rod, and tup with an exhaust-port near the top of said cylinder, a valve, a spring pressing said valve inward to its seat, an exhaust-port near the middle of the cylinder, provided with a valve, a spring pressing said valve outward to its seat, and a movable wedge adapted simultaneously to increase the resistance of the spring which closes the upper valve and to open the lower valve in opposition to its spring, substantially as and for the purpose specified.

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